cut-off of ≤3°; for rotations >3°, patients were repositioned. Our protocol consisted of 5 consecutively CBCTs scans for the first week of treatment and 1 CBCT weekly during radiation therapy course. For each patient, mean translational displacements were off-line calculated on CBCT acquired during the first 5 fractions; these values were considered as systematic set-up errors and the corresponding displacements were then corrected if they exceeded 3 mm. Mean (M), median (MD), standard deviation (SD) and range of the displacements related to first 5 CBCTs scans and those corresponding to the all following CBCTs scans were calculated. Wilcoxon test was performed to evaluate statistically significant differences between the displacements related to the first week of treatment with those related to the remaining weeks.

Results: The M, MD, range and SD values are shown in Table 1.

TRANSLATIONS				
		FIRST 5 CT	AFTER FIRST 5 CT	ALL CT
x	Mean (cm)	0.19±0.12	0.18±0.10	0.19±0.11
	Range (cm)	0.01 – 0.46	0.02-0.37	0.01-0.46
	Median (cm)	0.15	0.16	0.16
	1° quartile (cm)	0.12	0.11	0.12
	3° quartile (cm)	0.28	0.25	0.25
y	Mean (cm)	0.20±0.18	0.14±0.11	0.18±0.15
	Range (cm)	0.01-0.88	0.02-0.42	0.01-0.88
	Median (cm)	0.17	0.15	0.16
	1° quartile (cm)	0.09	0.06	0.08
	3° quartile (cm)	0.22	0.21	0.21
z	Mean (cm)	0.14±0.12	0.19±0.20	0.17±0.16
	Range (cm)	0-0.57	0.03-0.97	0-0.97
	Median (cm)	0.12	0.14	0.14
	1° quartile (cm)	0.03	0.10	0.08
	3° quartile (cm)	0.22	0.21	0.23
ROTATIONS				
				ALL CT
x	Mean (°)			-0.67±0.68
	Range (°)			-2.60 - 0.80
	Median (°)			-0.60
	1° quartile (°)			-1.20
	3° quartile (°)			-0.20
y	Mean (°)			-0.28±1.09
	Range (°)			-4.00 - 2.70
	Median (°)			-0.10
	1° quartile (°)			-0.90
	3° quartile (°)			0.30
z	Mean (°)			-0.60±0.75
	Range (°)			-2.60 - 0.80
	Median (°)			-0.50
	1° quartile (°)			-1.15
	3° quartile (°)			0.00

Based on this table, all translational values were <3 mm and within 2 mm for all CBCTs and the rotations were <3° and within 2°. Moreover, the Wilcoxon test showed none statistically significant correlation between the M calculated during first five fractions and the following CBCTs scans.

Conclusion: In our study, we have analyzed translational and rotational set-up uncertainties in Head and Neck cancer treatments using CBCT. We found that all the displacements were within 2 mm and 2°, well below the offset established (3 mm and 3° respectively). In the future we intend to reduce the margin from CTV to PTV considering the accuracy of our set-up.

EP-1784

Effect of body mass index on setup errors in patients treated with pelvic image guided radiotherapy

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Purpose or Objective: To retrospectively evaluate the effect of body mass index (BMI) on *set-up* errors in patients treated with image guided radiotherapy (IGRT) for pelvic malignancies. Additionally, based on these findings, we intended to determine optimal PTV margins in pelvic IGRT for patients with similar BMI values

Material and Methods: The datas from 73 patients who received pelvic IGRT between March 2014 and February 2015 were analyzed. BMI of each patient were calculated and patients were groupped as underweight (<18.5), normal weight (18.5–24.9), overweight (25–29.9) and obese ≥(30) according to National Institutes of Health classification. According to World Health Organization criteria, patients whose ages≥ 65 were evaluated as elderly. All patients received pelvic volumetric modulated arc therapy with Varian Truebeam STx ® linear accelerator. Before each treatment, orthogonal kV and CBCT images were taken and matched with bony anatomy and soft tissues respectively. The requisite couch shifts were made with online procedure and mean absolute shifts of X, Y, Z, 3D vectorial (V) axes for each imaging modality were obtained. Non-parametric tests were used for statistical analyses. Estimated CTV to PTV margins for *set-up* uncertainties calculated seperately for each group by using "Van Herk formula"

Results: The median age was 65 (36-86) and 70% were male. Totally 513 CBCT and 2064 kV images were evaulated. Mean absolute shifts in X, Y, Z, V axes with kV imaging were 3.39, 2.58, 2.85, 6.11 mm while with CBCT imaging 3.47, 2.90, 3.22, 6.54 mm, respectively. According to BMI groups; mean absolute shifts in X, Y, Z, V axes with kV imaging were 2.82, 2.67, 2.73, 5.54 mm for BMI<25; 3.57, 2.28, 2.81, 6.16 mm for BMI 25-29.9; 3.78, 3.14, 3.12, 6.82 mm for BMI≥30 while with CBCT imaging 3.16, 2.87, 2.82, 6.01 mm for BMI<25; 3.65, 2.92, 3.34, 6.74 mm for BMI 25-29.9; 3.49, 2.89, 3.51, 6.81 mm for BMI ≥30 respectively. Between BMI groups, only V axis shifts in kV imaging were statistically different (p:0.039). This difference is explained by sex distrubition differences in BMI groups and significantly higher obese group ratio in females (p:0.002). In females mean shifts in all axes were greater than males (p<0.05). Absolute shifts in V axis with CBCT imaging were statistically different between age groups and were significantly greater for 65 age group (p:0.041). In all patients, depending on absolute shift data; estimated CTV to PTV margins in X, Y, Z, V axes with kV imaging were 4.29, 3.99, 4.52, 5.62 mm; with CBCT imaging 4.71, 5.24, 4.93, 6.80 mm respectively

Conclusion: In our study we did not find any statistically significant difference in none of the axes between absolute shifts according to BMI groupes. However; because of greater shifts observed in females and 65 age group, more attention is needed in this group of patients' *set*-ups and PTV margins for these groups in planning process must evaulated more detailed

EP-1785

Comparison of setup errors and comfort levels of two immobilisation systems for head and neck cancer

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Purpose or Objective: This is a Prospective observational study. This study aims to quantify and compare the systematic and random error in two types of immobilization devices namely five point ray cast and BrainLAB immobilization system. This study also looks at the effect of weight loss on the setup error and patients comfort grade in both the immobilization devices. All patients of Head and Neck malignancy planned with Intensity Modulated Radiotherapy [IMRT] were assigned either a five point ray cast or BrainLAB ray immobilization as fixation device.

Material and Methods: Patient diagnosed to have head and neck malignancy were assigned to either of the group and prospectively analysed the displacement errors. In both the groups, systematic and random errors were analysed. The CTV-PTV margin was calculated using Van Herks formula and compared. The upper neck and lower bony neck points were also analysed in terms of systematic error, random error and CTV-PTV margin. All the patients were serially monitored with weekly weight and its impact was analysed on the setup errors and margins. Patients' comfort level was analysed at the completion of treatment in both the immobilization devices.

Results: The five point ray cast and BrainLAB immobilization was found to be similar in terms of systematic errors and random errors, except in the anterior-posterior [AP] and medial-lateral axis [ML]. BrainLAB showed significant less margin in ML axis [3.61 Vs 3.14 mm, p=0.0005] and in AP axis [3.33 Vs 2.66 mm, p=0.0001] The total margin required was similar in both the groups. The margin requirement in the upper neck fields was marginally better in the BrianLAB system than the five point ray cast. Weight loss of more than 3kg required more margins, but was not statistically significant. Comfort levels were same in both the groups.

Conclusion: The total CTV-PTV margin requirement for five point ray cast and BrainLAB immobilization is less than 5mm in all three directions. In patients requiring only upper neck irradiation BrainLAB system is recommended. Overall Five point ray cast and BrainLAB immobilization was comparable in terms of setup errors, margins and comfort levels.

EP-1786

Rectal distension impact on prostate CBCT-based positioning assessed with 6 degrees of freedom couch

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Purpose or Objective: The prostate requires a daily correction of its position in relation with rectal distension. With 6 degrees of freedom (DOF) couch, it is possible to correct the pitch and the roll. In this study, we sought to determine whether rectal distension might have an impact on any of these prostate translations and/or rotations during a protracted course of external beam radiation therapy for a localized prostate cancer

Material and Methods: The data from 15 patients with localized prostate cancer patients treated with 6 DOF cough in a single institution. Before each fraction, a CBCT was performed. The automatic fusion algorithm was set to fuse on soft tissue and it allowed correction for translations in three dimensions and rotation in the transverse plane (‘‘roll”) and axial plane (“pitch”).The rectum was contoured on each CBCT by one radiation oncologist. We determine the Cross Sectional Area (CSA) and relative CSA (CSArel) by dividing with the CSA of planning CT. The median was used to classify the patients in two groups: patients with a stable CSA and patients with an unstable CSA. The CSArel was compared between these two groups with a linear mixed model with group as fixed effect and patient as random effect

Results: Two hundred and ninety seven kV-CBCT were analyzed. Seven patients had a small and stable rectum : CSArel (1.07±0.09). The other eight patients had a unstable rectum: CSArel (1.37±0.07). The average pitch in the group with a stable rectum was 0.73° (+/-0.32) versus 0.04° (+/-0.28) (p=0.112). The pitch was not correlated with the CSA rel (p=0.477, r=0.041). The average roll in the group with a stable rectum was 0.14° (+/-0.27) versus 0.03° (+/-0.25) (p=0.781). The roll was not correlated with the CSA (p=0.279, r=0.063). The average CSArel was higher and more variable in the unstable group (p=0.009) and (p=0.024) respectively

Conclusion: Rectal distension had neither impact on the pitch nor on the roll, which suggest that a 6 DOF couch have little interest in daily practice for prostate IGRT

EP-1787

View of interest of automatic registration for CBCT localisation of head and neck cancer

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Purpose or Objective: Use of IMRT in patients with head and neck carcinoma may lead to over- or underdosage of OAR and CTV due to changes in patients anatomy. CBCT is a valuable tool for patient setup verification and monitoring of dosimetric variation during radiotherapy. We evaluated the dependence of an automatic registration process on the size of a user defined view of interest (VOI). We compared these results with the manual registration defined by a physician, defined as gold standard.

Material and Methods: We retrospectively reviewed the records of 36 consecutive patients (107 fractions) with head and neck cancer who received radiation therapy between January 2015 and September 2015 at the Hospital of Turnhout. Three CBCT images at well-defined time points (start-, mid- and end-treatment) of each patient were matched to a reference CT image using the Siemens Syngo RT Therapist version R 4.3. Images were acquired with MVision™ (6 MV photon beam tuned for imaging). Auto global registration is the automatic alignment of planning and treatment images using voxel based registration. Manual VOI function allows restricting the voxel based automatic registration to a user defined region. Registrations were performed with 2 VOI sizes (large (VOI = whole CBCT) and small (VOI = delineated CTV + body of adjacent vertebra)). Automatic registrations (AR) were compared with a manual registration (MR) made by a physician. It was only possible to make translational corrections in the vertical, longitudinal and lateral direction. To quantify overall distance between gold standard and automatic registration, the 3D-difference (d) was calculated:
$d = \sqrt{((AR-MR)^2_{lateral} + (AR-MR)^2_{longitudinal} + (AR-MR)^2_{vertical})}$.

Results: The CBCT images of 107 fractions were analysed. Automatic registration results depend on the volume of VOI (large or small). A paired t-test calculated the mean 3D difference for the automatic registrations with small VOI was significantly smaller ($p < 0.001$) than the mean value for automatic registrations using the large VOI. 3D differences were divided in multiple ranges. Small VOI resulted in differences ≤ 2 mm between automatic registration and radiation oncologist registration in 56,1% of the cases. When using large VOI, it resulted in differences≤ 2 mm in 6.5% of the cases. Compared with radiation oncologist registration, small VOI resulted in differences > 6 mm in 5.6% of the cases. Large VOI resulted in differences > 6 mm in 24.3% of the cases.

Table 1: Summary showing 3D differences (mm) between automatic registration (large VOI and small VOI) and manual registration by a radiation oncologist

	Large VOI	Small VOI
Mean (standard deviation)	4.88 mm (2.14)	2.36 mm (1.93)
Median	4.58 mm	2.00 mm
Maximum	10.36 mm	11.36 mm
d = 0-2 mm	6.54 %	56.07 %
d = 2-4 mm	31.78 %	30.84 %
d = 4-6 mm	37.38 %	7.48 %
d > 6 mm	24.30 %	5.61 %

Conclusion: Automatic registrations can produce results which are comparable to manual registrations by radiation oncologist. Registration parameters for CBCT affect differences between automatic and manual registration although patients wear a plastic mask during radiation therapy. Using a small VOI (delineated CTV + body of adjacent vertebra) results in small differences between automatic and manual registration. If large VOI is used it can result in differences > 6 mm in more than 20% of the cases.

EP-1788

Accurate and stable immobilisation with Lorca Marin masks for head and neck IMRT verified by IGRT

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Purpose or Objective: IMRT needs accurate and repeatedly image controls to verify online the patient position and check that the tumor is properly included. The aim of this work is to analyze the setup accuracy and stability resulting from the use of the Lorca Marin thermoplastic masks during the complete course in head and neck cancer treatment with intensity modulated techniques.